TRANSLATION

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Form PCT/IPEA/416
4465-X-22934		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP2004/012911	14.11.2004	14.11.2003
International Patent Classification (IPC) or national classification and IPC		
C01 B25/45, H01 M4/58, H01 M4/02		
Applicant		
SÜD-CHEMIE AG		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☐ *(sent to the applicant and to the International Bureau)* a total of _____ sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))
      _____ , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
Name and mailing address of the IPEA/EP Facsimile No.	Authorized officer Telephone No.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/012911

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on translations from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

☐ international search (Rule 12.3 and 23.1(b))

☐ publication of the international application (Rule 12.4)

☐ international preliminary examination (Rule 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:

pages 1-32 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

nos. 1-40 as originally filed/furnished

nos.* _____ as amended (together with any statement) under Article 19

nos.* _____ received by this Authority on _____

nos.* _____ received by this Authority on _____

☒ the drawings:

sheets 1/3-3/3 as originally filed/furnished

sheets* _____ received by this Authority on _____

sheets* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/012911

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-40	YES
	Claims		NO
Inventive step (IS)	Claims	1-40	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-40	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

1. This report makes reference to the following documents:

D1: WO 02/083555 A (ZENTRUM FUER SONNENENERGIE- UND WASSERSTOFF-FORSCHUNG BADEN-WUERTTEMBE) 24 October 2002 (2002-10-24)

D2: ARNOLD G ET AL: "Fine-particle lithium iron phosphate $LiFePO_4$ synthesized by a new low-cost aqueous precipitation technique" JOURNAL OF POWER SOURCES, ELSEVIER SEQUOIA S.A. LAUSANNE, CH, Vol. 119-121, 1 June 2003 (2003-06-01), pages 247-251, XP004430175 ISSN: 0378-7753

D3: WO 02/099913 A (N.V. UMICORE S.A; WURM, CALIN; MORCRETTE, MATHIEU; GWIZDALA, SYLVAIN;) 12 December 2002 (2002-12-12)

2. Novelty

D1 is regarded as the prior art closest to the subject matter of claim 1. It discloses a

method for producing binary, ternary, and quaternary lithium phosphates of the formula $Li(Fe_xM^1_yM^2_z)PO_4$. Precursor compounds of the elements Li, Fe, M^1 and/or M^2 are precipitated from an aqueous solution and the precipitate is dried in a non-oxidizing atmosphere and then tempered. The particle size analysis of the lithium phosphate obtained results in a very narrow particle size distribution with an average particle size (D_{50}) of less than 3 µm.

Therefore, the subject matter of claim 1 differs from the known method in that the precursor suspension is not dried and tempered immediately after the precipitate is obtained, but rather first subjected to a dispersion or grinding treatment.

Consequently, the subject matter of the **method claims 1-26 and 36-40** is novel (PCT Article 33(2)).

Claim 27 relates to a product obtainable according to one of the method claims 1-26. The claim does not, however, contain any product features that would enable a person skilled in the art to differentiate the $LiMPO_4$ in the claim from the lithium metal phosphates in the prior art.

The description indicates that such a product

has a D_{90} particle value of at most 25 µm, a D_{50} value of less than 0.8 µm, and a D_{10} value of less than 0.35 µm (page 15, first paragraph).

D2 discloses a method for producing phase-pure, homogeneous, crystalline $LiFePO_4$. A precursor material is precipitated from an aqueous solution and then heated to a temperature of 650-800°C. The product has the following particle size distribution: a D_{90} particle value of approximately 15 µm, a D_{50} value of approximately 7 µm, and a D_{10} value of approximately 3 µm (figure 4).

D3 discloses a lithium-transition metal phosphate with an average particle size of less than 1 µm and a specific surface area of 2.84 m^2/g (table 1).

Therefore, **claims 27-31** are novel.

Since the $LiFePO_4$ in claim 27 is novel, a composition containing it, its use as electrode material, and a secondary battery containing the composition are likewise novel.

Consequently, **claims 32-35** are novel.

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

3. Inventive step

The problem to be solved by the present application is that of providing a method for producing lithium metal phosphate that results in material suitable for the electrodes of rechargeable batteries.

The solution to this problem as proposed in the present application involves an inventive step for the following reasons (PCT Article 33(3)):

The main difference between the production method in the prior art and the method in the present application is that the precursor mixture and/or precursor suspension is subjected to a dispersion or grinding treatment. The prior art contains nothing that suggests such a treatment as relates to the production of lithium metal phosphate.

The examples indicate that the compound ($LiFePO_4$) produced according to the application shows better electrochemical properties, in particular at high charge and discharge rates, than a material produced according to the prior art.

The production method, the $LiFePO_4$ produced according to the application, its use as electrode material, and a secondary battery

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

containing a $LiFePO_4$ composition produced according to the application all involve an inventive step. **Claims 1-40** are regarded as inventive.